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CGH SEMINAR

«Pre-cleaning of Medical Devices and the fight against nosocomiales infections »

Endy Li
Franklab Taiwan

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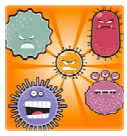
Nosocomiale infection

Nosocomiale infection is a infection that a patient get during his stays in the hospital



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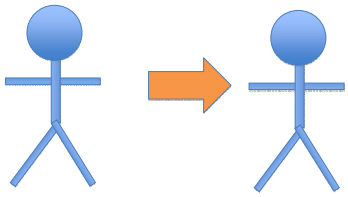
Direct Cross Contamination :



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Exemple for Direct Cross Contamination

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Exemple for Indirect Contamination

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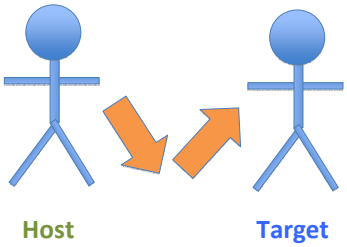
INDIRECT CONTAMINATION

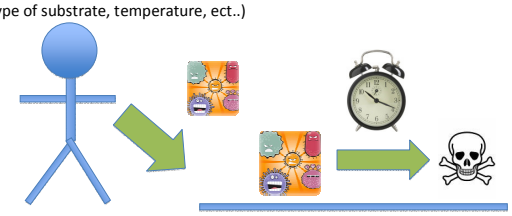


TRANSMISSION OF GERMES

Germs not present naturally in the l'environnement :

The germ that have been dropped in a new environement will be in a state of survival because this environement is not favorbale for them.

They will die after minutes or hours, depending on many factors (type of germ, type of substrate, temperature, ect..)



TRANSMISSION OF GERMES

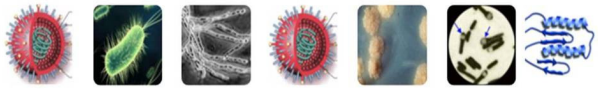
Germe Already present in environnement :

These germes will be able to reproduce fastly and colonise the new substrate in favorable conditions

RESISTENCY OF GERMS

Resistancy of microorganismes

(Favero & Bond – 1991)



Small virus	Microbe	Fungus	Virus	Mycobacterium	Spore	Prion
(HIV, H1N1) H1N1 is destroyed in 10H in open air	(Staphylococcus aureus)	(Aspergillose)	(Poliovirus, Adenovirus)	Big size microbe (Bacillus Koch BK)	Bacteria able to sporulate	Creutzfeld-Jakob Alzheimer

Easy Destruction — **Difficult Destruction**

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Where does they hide ?

Sol	Main	Instruments	Endoscope	Air	Bassin
salle de bloc, couloirs, toilette...	Avant et aprés oscultation d'un patient	pince, scalpel...	rigide et souple	Zone ou le risque de contagion est fort : bloc, chambres...	
Floor, Surfaces, Toilets	Hands	Instruments	Endoscopes	Air, Patients room, operating room	Items used by patients

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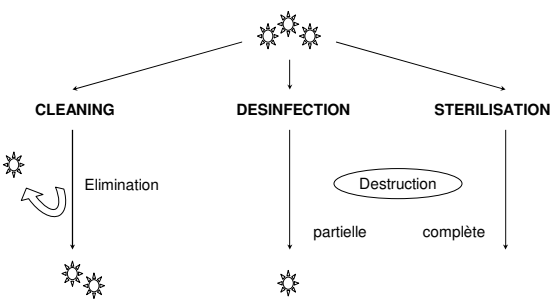
WAYS TO REDUCE NOSOCOMIAL INFECTIONS



The 9 Germs who cover 90%

Family	Germs	Percentage
Bacteria	Escherichia coli	22
Bacteria	Staphylococcus aureus	17
Bacteria	Pseudomonas aeruginosa	11
Bacteria	Enterococcus	9.1
Bacteria	Proteus sp.	7.6
Bacteria	Staphylococcus à coagulase négative	7.6
Fungus	Fungi	6.0
Bacteria	Klebsiella sp.	4.4
Bacteria	Enterobacter sp.	3.7

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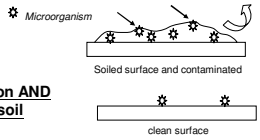
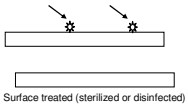
IMPORTANCE OF CLEANING (PRE TREATMENT)



Pre-traitement

Goal : Reduce the contamination AND Eliminate organic and mineral soil

Treatment (Disinfection)
Goal: Destruction of the residuals microorganisms



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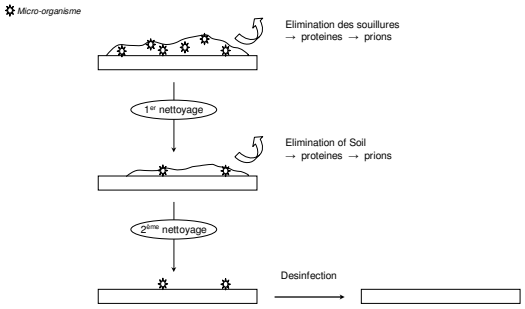
DOUBLE CLEANING



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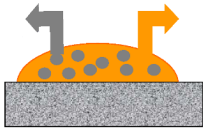
WHAT IS A SOIL ?

- Germes / Microbes
- Microparticules solides
- Calcaires
- Graphites
- cellulaires Membranes
- Proteines



- Vegetable Oil
- Human Oil
- Lipides
- Graisse

NEVER DESINFECT WHAT IS DIRTY !

REMOVE ALWAYS THE SOIL BEFORE TO DESTROY MICROBES !

OTHERWISE U MAKE THE MICROBE STRONGUER !

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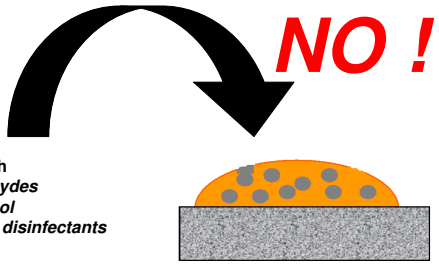

- **Bleach**
- ***Aldehydes***
- ***Alcohol***
- ***Other disinfectants***

DESINFECTANTS BURNS THE SURFACE OF GREASES, MICROBES ARE HIDDEN UNDER THIS SURFACE
YOU MAKE A SHIELD FOR THEM !

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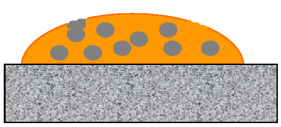
- **Detergents**
- ***Soap***
- ***Surfacants***
- ***Enzymes***



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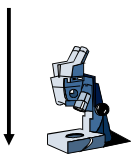
Pre-disinfection or Cleaning

Macroscopique Dirty
We can see by eyes

Disinfection & sterilisation



Microscopique Dirty
We don't see by eyes !

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How Does DETERGENTS Work

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SURFACTANTS

ENZYMES

ZETA POTENTIAL

CHELATING

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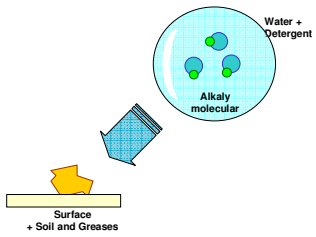
SAPONIFICATION OF GREASES



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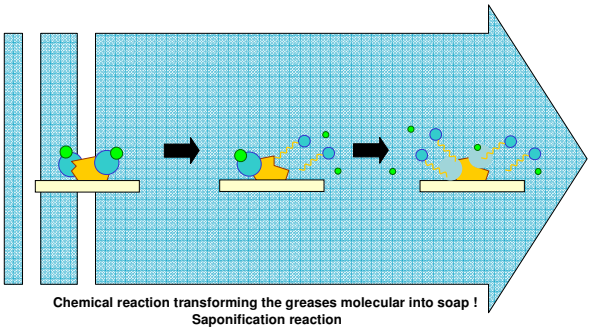

Chemical reaction transforming the greases molecular into soap !
Saponification reaction

FONCTIONNEMENT DES DETERGENTS

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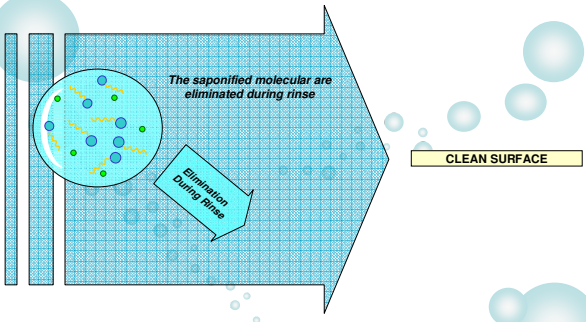

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SURFACTANTS

ENZYMES

ZETA POTENTIAL

CHELATING

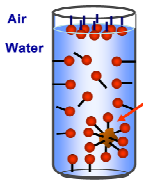
Chemical Structure 化學結構

	不親水	親水性
Water:	Hydrophobic part	Hydrophilic part
Oil:	Lipophilic	Lipophobic
	親油	不親油

The balance between the two parts is decisive for the properties of the surfactant!!

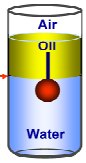
親水及親油的平衡就是界面活性劑的特性!

Surfactants 界面活性劑基本介紹



Surface active molecules orientate themselves in the interface between two phases.

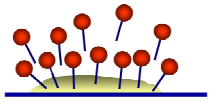
When the surface is saturated with surfactants they start to form spherical globules in the water, which are called **micelles.**



Interfacial tension

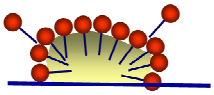
Removal of Oily/ Greasy Soils

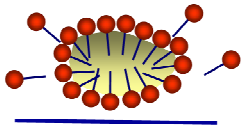
顏料油污的去除



The hydrophobic (lipophilic) chain is attracted by the soil and penetrates it.

The surfactants force the soil to open and to detach from the surface.





The soil is detached from the surface.

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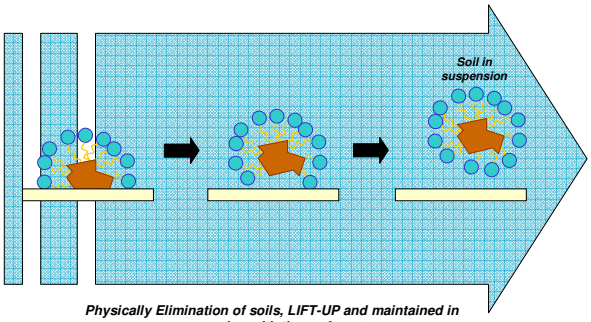
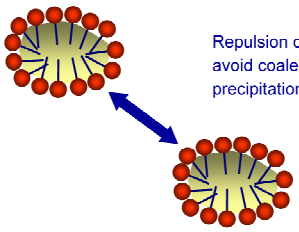


Physically Elimination of soils, LIFT-UP and maintained in suspension with the surfacants

Pigment Removal 顏料的去除



Repulsion of the head groups avoid coalescenece and precipitations of the particles.

Surfactants adsorbing on hydrophobic particles

Oily Soil on Different Substrates

不同基板上的油污

Energy needed to remove oily soil

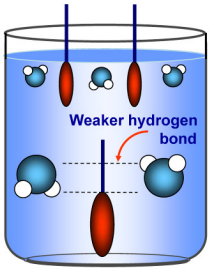
$W_{adhesion} = \gamma_{O/W} + \gamma_{S/W} - \gamma_{O/S}$

Hydrophobic solid:	$\gamma_{S/W}$ higher	$\gamma_{O/S}$ lower	$W_{adhesion}$ higher
Hydrophilic solid:	$\gamma_{S/W}$ lower	$\gamma_{O/S}$ higher	$W_{adhesion}$ lower
	$\gamma_{O/W}$ same in both cases		

Conclusion: More difficult to remove oily soil from more hydrophobic surfaces (e.g plastic surfaces)

The Influence of Surfactants on Surface Tension

界面活性劑在表面張力的影響



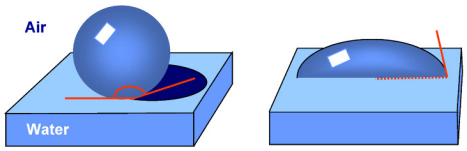
The surfactants orientate themselves in between the water molecules and disturb their "hand-holding". The force is then lowered.

For some surfactants the surface tension can be reduced to ~30 mN/m or even lower.

Wetting 溼度

Bad wetting, high surface tension, big contact angle

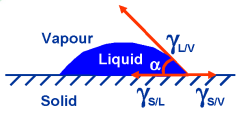
Good wetting, low surface tension, small contact angle



Contact angle reduction is the key!

關鍵是降低接觸角!

Young's Equation(1805)



γ = surface/ interfacial tension

$\gamma_{S/V} = \gamma_{S/L} + \gamma_{L/V} \cdot \cos\alpha$

For any non-wetting conditions: $\cos\alpha < 1$, thus

$\gamma_{S/V} < \gamma_{S/L} + \gamma_{L/V}$ for non-wetting conditions!

The contact angle is given by: $\cos\alpha = \frac{\gamma_{S/V} - \gamma_{S/L}}{\gamma_{L/V}}$

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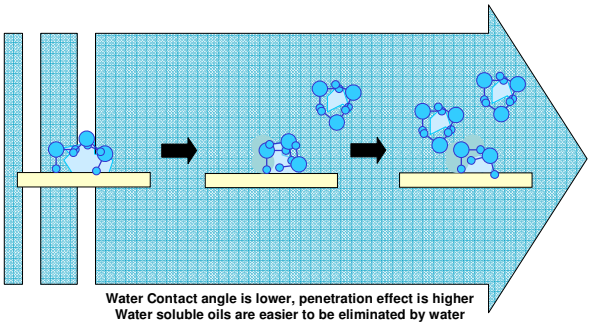

Water Contact angle is lower, penetration effect is higher
Water soluble oils are easier to be eliminated by water

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SURFACTANT

Surfacant can act on the dirty by:

- **Dissolution** of water soluble soils

(contact angle lower)

- **Emulsification** of non water soluble soils

(Tail is attracted to oil)

- **Lift-UP** of solid particles from substrates

(surfactant around particles)

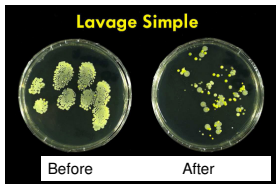
HANDS HYGIENE

Biocidium *Lotion TA*

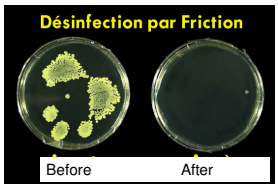
Propriété :
Bactéricide : NF EN 1040
NFT 72 171
NF T 72 151
Fongicide : NFT 72 201
Virucide : actif sur le virus H1N1

Mode d'emploi :
Prêt à l'emploi

Effeciency of Surfacants only !



Normal Soap



BIOCIDIUM Lotion TA

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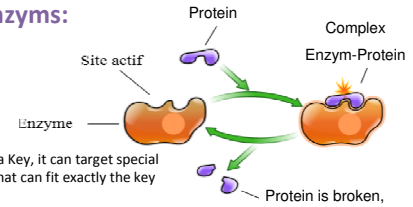
Action of Enzyms:



- The Enzyme is like a Key, it can target special Lipides or Proteins that can fit exactly the key shape.
- Once Protein fit in the key, intra-electronic forces of molecula break the protein
- The Protein parts are released
- The Cycle can Restart

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ENZYMS

Enzyms can act on the dirty by:

- **Destruction** into smaller molecular
- **Can be Re-Use** long time in the bath because of catalytical reaction.
- **Alkaly-Sensitive** Enzyms can die fastly into alkaline solution.

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SURFACTANTS

ENZYMES

ZETA POTENTIAL

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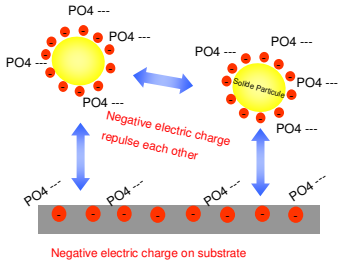
Zeta Potential:

- Detergent contain ionic charges.
- Ions like PO4--- gives negative electronic charges to the dirty and the substrate
- Electronic charges generate a repulsive power that separate dirty from substrate



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NUCLEAR MEDICINE DECONTAMINATION

... Action of Chelating molecular

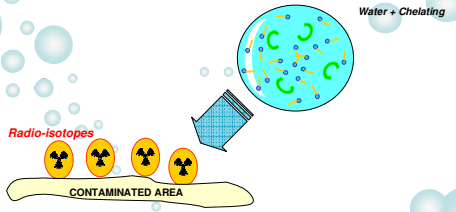

Chart Explain

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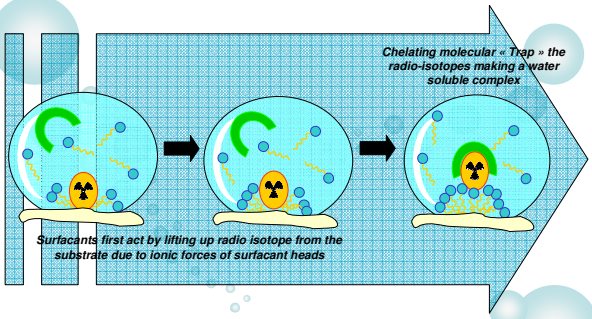
Chelating molecular « Trap » the radio-isotopes making a water soluble complex
Surfacants first act by lifting up radio isotope from the substrate due to ionic forces of surfacant heads

Chart Explain

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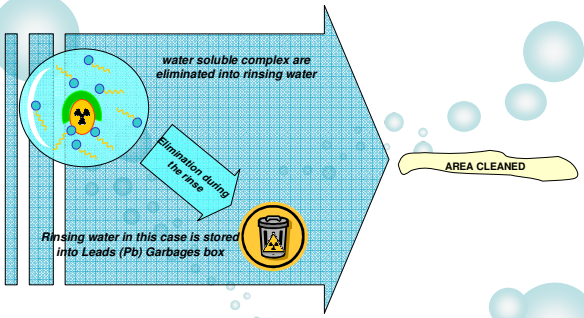

water soluble complex are eliminated into rinsing water
Elimination during the rinse
AREA CLEANED
Rinsing water in this case is stored into Leads (Pb) Garbages box

Chart Explain

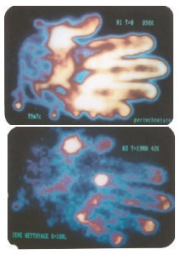
EFFECIENCY OF CHELATING

TFD Peau

GAMMA PHOTO ON HANDS: Nuclear Medicine

Before :
Contamination on Hand
With 148 Mbq of Tc99

After Using Chelating :
Contamination reduced
To less than 4 Mbq



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How To Use DETERGENTS

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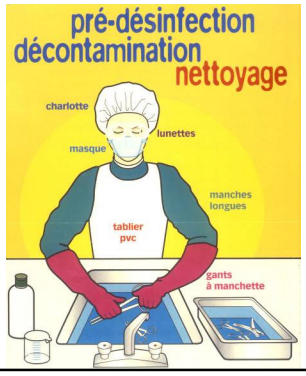
INDIVIDUAL PROTECTION

- **Charlotte (hairs)**
- **Glass's (Eyes)**
- **Mask (Mouse/Nose)**
- **Long sleves (Arms)**
- **Long Gloves (Hands)**
- **Tablier (water prove dress)**



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➢ ***TOXICITY of DETERGENTS and DESINFECTANTS***

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TYPES OF TOXICITY

- Accute skin Toxicity
- RespiratoryToxicity
- Toxicity by ingestion
- Sensibilisation
- Ocular Toxicité (Eyes)

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BASIC'S ABOUT TOXICITY

Evaluation :

- Toxicity of the whole formula, and not only the main actif substences
- Toxicity of solution after dilution, AND the way to use
- Environnementale Toxicity : Elimination of gaz and liquids residues

Precautions to care about :

- Disinfectants = Chemicals → take the minimum protection for users
- Handle concentrated products with a lot of care !
- Do not confuse toxicity and bad smell !

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Dermite due to allergy because of glutaraldéhyde (endoscopy assistante)

Dermite due to allergy because of glutaraldéhyde (Denstist assistante)

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Dermite due to contact irritation due to Nitril gloves when disinfection endoscopes.

The glove should always be tests and qualifeid over the detergents and the disinfectant used

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Basic things to respect :

- Handle One product at once
- Do not REPACK the products
- All bottles should be labeled and closed
- Read the storage instructions, and conform to it
- Respect the date of peremption
- Keep a clear instructions of uses visible to eyes

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Fill in Water preferably hot water (40°C)

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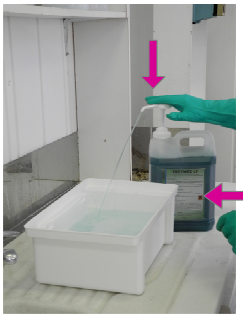
Dilute detergent into water, according to the instructions



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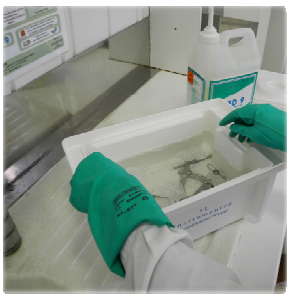

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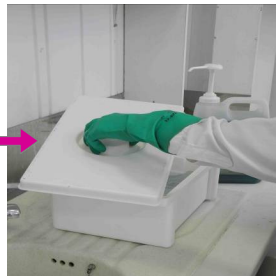
Close the tanks is better



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Before to use :

- Make sure ur hands are clean
- Remove all jewerly , rings, bracelts…
- Make sure the gloves are sutable, and compatible

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ENZYMEX L9 :

Detergent disinfectant Enzym based for pre-cleaning of medical devices, (surgical instruments or endoscopes).

Activity :

Bactericide : NF EN 1040 (1 min.)
NF EN 13727 (5 min.)
Fungucidal : NF EN 13624 (5 min.)
NF EN 1275 (5 min.)
Virucide : NF T 72-180 (15 min.)
Actif sur VIH, VHB et Rotavirus

Usage Way :

Dilute 25mL for 5L of water

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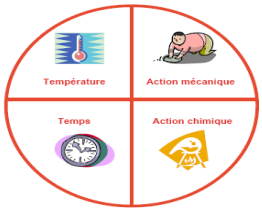
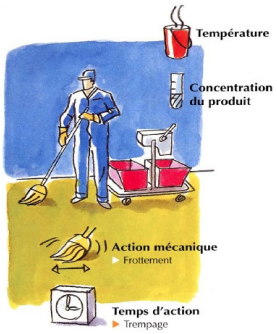
How To Use DETERGENTS ON THE FLOORS & SURFACES

LES SOLS ET SURFACES

Sequential circle of de Sinner



Le cercle séquentiel de " Sinner "



LES SOLS ET SURFACES

Definition of Zones and Hazard :

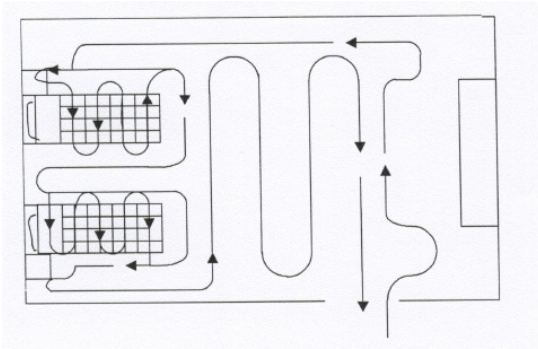
Low Hazard	Middle Hazard	Accute Hazard	Very High Hazard
Lobby entrance Bureau Administration	Circulation Maternity Consultation Pharmacy Sterilisation Laundry	Reanimation Radiology Hemodialisys Laboratory Kitchen Toilets	Operating room Neo-Natology Transplantation ……

Classification en zone à risque	1	2	3	4
Type de nettoyage	Nettoyage selon protocole		Bio Nettoyage selon protocole	
Fréquence	En fonction de l'utilisation des locaux	Quotidienne	Quotidienne ou pluri quotidienne	Pluri quotidienne et après chaque utilisation
Organisation	Selon les horaires d'activités		Selon les horaires de soins	
Matériel	Aspirateur Balais de lavage Auto laveuse laveuse	Balai de lavage Lavette Auto laveuse		Balai de lavage lavette
Produits	Détergent	Détergent et détergent désinfectant (alternace)		Détergent désinfectant

LES SOLS ET SURFACES

1) Always from the most clean to the most dirty
2) From the upper level till the lower level
3) From outside sanitary/toilets till inside
4) Don't move up the mop from the ground, don't move back.

LES SOLS ET SURFACES



LES SOLS ET SURFACES

5) We never Disinfect what is dirty
6) Never Dry the surfaces, leave them to dry by themselves.
7) Take care od the contact places with persons (doors handles, light switch, phones, remote controls….)
8) Change the bath between rooms

LES SOLS ET SURFACES

TFD *Surf*:
Cleaning and Disinfection of the floors and the surfaces

Properties
Bactéricide : NF EN 1040 (5min, 20°C)
NF EN 1276 (5min, 20°C)
Fongicide : NF EN 1275 (5min, 20°C)
Candida albican
Virucide : actif selon la norme EN 14476 sur le virus de l'herpes

Usage :
20mL for 8L of waters

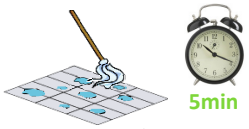
LES SOLS ET SURFACES

Fill in Water

Add **TFD Surf**

Mix

Clean



Leave it to dry for 5min

LES SOLS ET SURFACES

TFD *SPRAY* :
Cleaning and Disinfecting the surfaces, working plan, medical devices surfaces …

Properties :
Bactéricide : NF EN 1040 (5min, 20°C)
NF EN 13727 (5min, 20°C)
NF EN 1276 (5min, 20°C)
Fongicide : NF EN 1275 (5min, 20°C)
NF EN 13624 (5min, 20°C)
Virucide : actif selon la norme EN 14476 sur le virus de l'herpes

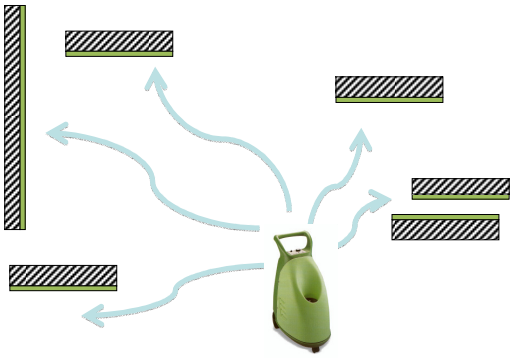
Usage
Ready to use

LES SOLS ET SURFACES

LES SOLS ET SURFACES

Airborn Desinfection

LES SOLS ET SURFACES



LES SOLS ET SURFACES

Aeroseptine 4

Désinfectant à base d'ammonium quaternaire pour la décontamination aérienne et la destruction des odeurs des blocs opératoires, des services de soins intensifs et de grands brûlés, des salles de soins, des chambres des patients...

Propriété :

Bactéricide : NF EN 1040 (5 min.)
NF EN 13727 (5 min.)
Fongicide : EN 1275 (5 min.)
Virucide : actif sur VIH, VHB, VHC

Mode d'emploi :

Brumisation sans dilution

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The Biofilms in hospital environment

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Pathogenes and non Pathogenes Biofilms

- E. coli
- Klapselia
- Piu
- Psedomonas
- Candida
- Streptococcus,
- S. aureus

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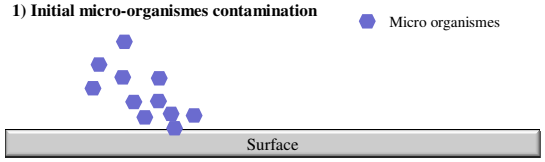
BIOFILM Formation

Formation is made into 4 steps :

1) Initial micro-organismes contamination



The surface contamination can be made by direct contact (door handle, phone.., computer keyboard)
By indirect contact (blood traces, spit,organic excrements…)
By Air (Cough, … ventilation system),
By Fluid constant flow (water pipe, toilets ….).

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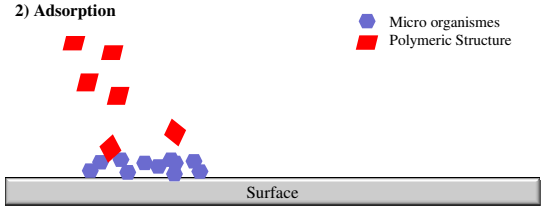
2) Adsorption



Adsorption can be made in few minutes, it is a result of a physico-chimical surfaces changes
Van der waals attraction power with surface
Electrostatique attraction / repulsion power
Acide /Alakly attraction power (De Lewis).
At this stage, Exo-polysaccharides are produced by the cell's, theses polymeric structure maintain the adhesion between micro-organism's

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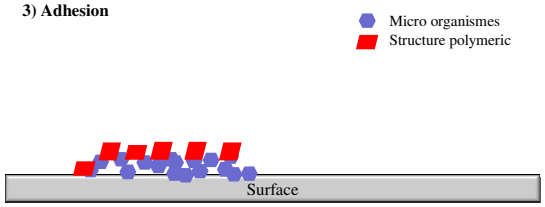
3) Adhesion



Adhesion can be made in few hours,
The Polymeric structures cover all the micro-organism's

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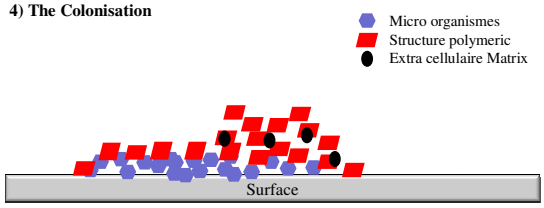
4) The Colonisation



The colonisation can last from few hours to many months
The bioflim is now stable, and the dead cells make a Extra Cellular Matrix that give a higher protection for all micro-organism inside

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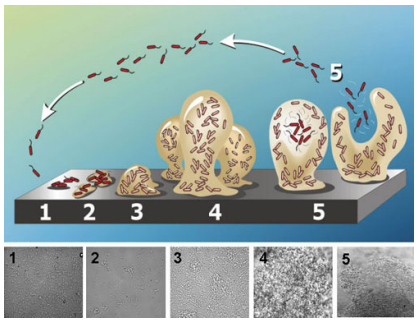
AND THE INVASION START ……



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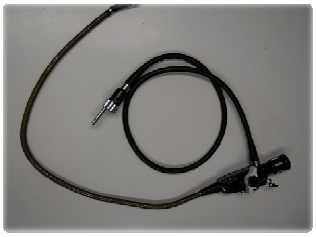
Biofilm in some critical places:



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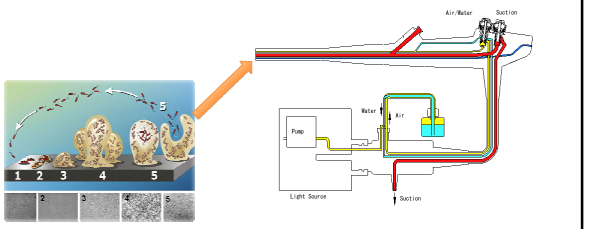
Biofilms can easely invade the inside channel's



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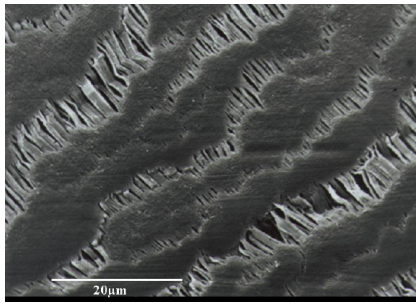
Inside of new endoscope



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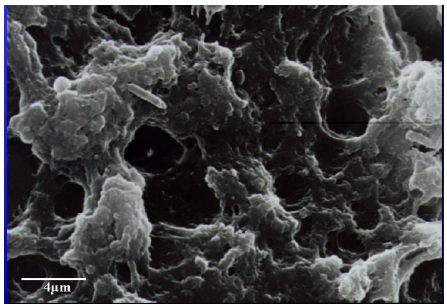
After 600 time usage .... !



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TFD 4 :

Nettoyage et dégraissage des sols, murs, surfaces et dispositifs médicaux (bloc services à hauts risques, services de soins).

Propriété :
Strong Surfacant Detergent
Biofilm removal

Usage :
Dilute to 2 to 5%
Use once on the endoscpe for maintenance

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Bactericidal :

Normes	Souches	Réduction minimum du nombre de cellules viables	Concentration	Durée de contact	Température
NF EN 13727 *Conditions de propreté*	*Staphylococcus aureus* *Pseudomonas aeruginosa* *Enterococcus hirae*	5 log			20 °C
NF EN 1040	*Staphylococcus aureus* *Pseudomonas aeruginosa*	5 log			20 °C
NFT 72 171 (spectre 4) *Conditions de saleté*	*Pseudomonas aeruginosa* *Escherichia coli* *Staphylococcus aureus* *Enterococcus hirae*	5 log			20 °C
NF T 72171 *Conditions de propreté*	*Mycobacterium smegmatis*	5 log			20 °C

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Fongucidal :

Normes	Souches	Réduction minimum du nombre de cellules viables	Concentration	Durée de contact	Température
EN 13624 *Conditions de propreté*	*Candida albicans*	4 log			20 °C
EN 1275	*Candida albicans* *Aspergillus niger*	4 log			20 °C

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Virucidal :

Normes	Souches	Réduction minimum du nombre de cellules viables	Concentration	Durée de contact	température
NF T 72 180	*Poliovirus sabin s. vaccinale*	6 log			20 ℃
NF T 72 180	*Adenovirus type 5*	4 log			20 ℃
Actif sur HIV, HBV, HBC et Rotavirus					

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Mycobactericidal :

Normes	Souches	Réduction minimum du nombre de cellules viables	Concentration	Durée de contact	Température
NF EN 14348 *Conditions de propreté*	*Mycobacterium terrae* *Mycobacterium avium*	5 log			20 ℃
Actif sur *Mycobacterium tuberculosis*					

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Sporicidal :

Normes	Souches	Réduction minimum du nombre de cellules viables	Concentration	Durée de contact	température
EN 14347	*Bacillus cereus* *Bacillus subtilis subsp spizizenii*	5 log	80 %	25 min.	20 ℃

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CGH SEMINAR

Thanks for listening

李思緯Endy Li
+886 918 288645
endy@taiwan.franklab.com
Franklab Taiwan